INVESTIGATOR'S ANNUAL REPORT

National Park Service

All or some of the information provided may be available to the public

Reporting Year: 2004	**Park:** Shenandoah NP
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Permit#:
SHEN-2000-SCI-0001

Park-assigned Study Id. #:
SHEN-00203

Project Title:
Dating of Ground Water in Shenandoah National Park

Permit Start Date: Jan 01, 2000	**Permit Expiration Date** Jan 01, 2005
Study Start Date: Jan 01, 2000	**Study End Date** Jan 01, 2010

Study Status:
Continuing

Activity Type:
Research

Subject/Discipline:
Water / Hydrology

Objectives:

The overall objective of this work is to provide new information on the age and residence time of groundwater that discharges from springs in Shenandoah National Park. Measurements of a suite of environmental tracers are being used, including atmospheric chlorofluorocarbons (CFCs) and sulfur hexafluoride (SF6). It is expected that this work will have transfer value to dating of spring discharge, and interpretation of hydrochemical records of spring discharge. Specifically, we are looking at processes that affect the initial CFC and SF6 concentrations in the unsaturated zone. We are also using detailed records of thermal data to investigate the transient response of spring discharge to meteorological events. In a related study, 50 karst springs were sampled throughout the Great Valley west of SHEN throughout Virginia in 2004. Measurements include CFCs, SF6, 3H/3He, dissolved gases, tritium, major and minor element chemistry and carbon-14. These data will be used in the near future to evaluate mixing and water ages.

Findings and Status:

Data collection continued in 2004 to further refine interpretation of groundwater age in SHEN and to improve understanding of temporal discharge from springs. The data collection includes the following: 1. Detailed temporal measurements of water temperature and specific conductance were recorded at 30-minute intervals in discharge from Furnace spring where there is now a 72-month record. 2. We are continuing full sampling (chemistry, isotopes, major dissolved gases, CFCs, SF6) at monthly intervals at Furnace, Lewis, Birds Nest 3, Browntown Valley Overlook spring and Hudson spring (Luray, VA). 3. We have concluded an approximately 5-year record of water temperature at 30-minute intervals at approximately 30 springs in the Park. 4. We concluded measured the composition of unsaturated-zone gases (CFCs, SF6, N2, Ar, CO2, O2) and unsaturated zone temperature in 6 unsaturated zone wells. This completed an approximate 2-year record of quarterly measurements of UZ gas composition. 6. We continue to analyze air collected approximately weekly at the Big Meadows Air Monitoring Station for CFCs and SF6. We continue to compile and evaluate these data. We have found that over the past 9+ years, air samples from the Big Meadows Air Monitoring Station have closely tracked North American air composition of CFC-11, CFC-12, and CFC-113 as recorded by NOAA at Niwot ridge, CO. There are occasional spikes in CFC-11 that exceed 30% of North American air. We have found seasonality in the unsaturated zone gas composition of CFCs (low in winter and high in summer) that seems to be, at least in part, related to soil temperature. These factors contribute to variations in apparent age that we have observed in discharge from many of the shallow springs in SHEN.

For this study, were one or more specimens collected and removed from the park but not destroyed during analyses?

Yes

Funding provided this reporting year by NPS:	Funding provided this reporting year by other sources:
0	30000

Fill out the following ONLY IF the National Park Service supported this project in this reporting year by providing money to a university or college	
Full name of college or university:	**Annual funding provided by NPS to university or college this reporting year:**
n/a	0